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TRANSLATION FROM RUSSIAN\*. GAGARINA, A. V. and NETSKY, G. I. (1955)\*\*.  
Data on distribution and vectors of hemorrhagic fever in western Siberia.  
Prirod. Ochag. Bolezn. Chelovek. Krayev. Epidemiol., (State Publishing  
House of Medical Literature) (MEDGIZ.,) pp. 220-224, (reprint ).

The teaching of Academician E. N. Pavlovsky on natural focality  
of infection has provided us with an opportunity to reveal several new  
diseases, including Omsk hemorrhagic fever, which was studied between  
1947 and 1948.

The basic clinical symptoms of this illness have been studied (R. M.  
Akhrem-Akhremovich, 1949; V. P. Konstantinov, G. A. Sizemova, and  
Yu. V. Veselov, 1949, et al.), epidemiological properties, the great  
probability of its transmittible nature, and the role played by ixodid  
ticks as vectors has been revealed (A. V. Fedyushin and G. I. Netsky,  
1949; M. V. Los, 1949, et al.), and the role of Dermacentor pictus  
Herm. as a vector has been experimentally demonstrated (M. P. Chumakov,  
1948; A. V. Gagarina, 1952; and A. A. Avakyan, 1949).

Natural foci of hemorrhagic fever were recorded in restricted  
localities of northern zone of west Siberian forest-steppe, where the  
ixodid fauna is represented by pure populations of Dermacentor pictus  
Herm.

Later, single cases of hemorrhagic fever were recorded in the  
vicinity of old foci, while radius of the territory with this illness  
was gradually becoming wider. Following an epidemiological "extinguish-  
ment" of old foci, "new" foci were revealed (A. V. Gagarina, 1952).

During the following years, co-workers of the Virological  
Laboratory of Omsk Institute of Epidemiology, Microbiology, and Hygiene  
studied dynamics and dislocation of natural foci of hemorrhagic fever,  
while co-workers of the Regional Tularemia Station continued study  
of the composition and peculiarities of distribution of ixodid ticks,  
with the aim of revealing borders of the territory in which natural  
foci of hemorrhagic fever exist, and they also investigated other  
ixodid species as possible vectors of this disease.

\* This translation was made for members of the U. S. Hemorrhagic Fever  
Delegation to the U.S.S.R. and for other interested persons.

\*\* From Virological and Parasitological Laboratory of Omsk Institute  
of Epidemiology, Microbiology and Hygiene of Ministry of Public  
Health of RSFSR.

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The nearest localities where this infection was revealed were located in a restricted sector on the site of transition of northern forest-steppe into the zone of swampy birch-aspen forests. Here, in some sectors, infection with hemorrhagic fever has been recorded among the local population as well as among newcomers for the last 8 years. Although most foci revealed earlier gradually became "extinguished", ticks collected within this zone remained infected with the virus (Table 1).

As may be seen from Table 1, the virus was isolated from a small number of ticks during general verification in focus "K" with annual infection, as well as in a locality where infection had not occurred for the last 4 years ("I-S").

Some data show that distribution of infected ticks in different foci is very irregular.

Thus, within one of the foci, during the period when people became infected with hemorrhagic fever, from 1,620 tick specimens, which were divided into 3 batches, and investigated by emulsion method, only one strain of Omsk hemorrhagic fever was isolated, while during the same period in other foci, in "extinguished" as well as foci with annual single cases of infection, the virus was easily isolated from considerably smaller number of ticks (2 batches - 611 and 230 specimens) that were investigated by the same method [Table 1, foci with annual infection and "extinguished"]<sup>7</sup>.

During investigation of ticks collected in the zone of small villages, where infection with Omsk hemorrhagic fever was not observed, the virus of this infection was also isolated ("URS").

It is important to mention that in one of such small villages, infection with this fever among newcomers was later recorded, while no infection occurred among local population.

The causes of epidemiological "extinguishment" of foci cannot be considered to be sufficiently elucidated. One cause may be the formation of a significant immunization layer, due to recovery from this illness of local population, followed by vaccination and absence of exchange of population.

It is necessary also to consider enlargement of the territory from year to year (utilization of virgin land for grain sowing, widening of pasture grounds, and sites of birch-aspen felling).

The causes of "extinguishment" of foci, are undoubtedly not exhausted by these factors.

Isolation of virus from ticks in "potential" foci demonstrated existence of foci, which remain concealed until a specific later period.

All the above enumerated strains of the virus isolated from ticks were identified as the virus of Omsk hemorrhagic fever (Table 2).

Circulation routes of the virus in nature are insufficiently elucidated.

However, wild rodents examined by A. V. Gagarina (narrow-skulled voles, hamsters, susliks, hedgehogs, and weasels) and also some bird species (crows, rooks, bitterns, and marsh harriers) proved to be susceptible to virus infection with subsequent formation of immunization.

Among bloodsucking mosquitoes, Mansonia (C) richardii maintained the virus after sucking blood of an infected calf with diagnosed viremia (A. V. Gagarina and G. I. Netsky). Spontaneous infection with Omsk hemorrhagic fever virus was repeatedly demonstrated only in ixodid ticks.

The "new" foci generally emerged southward from old foci in the northern forest-steppe, and in the southern forest-steppe or typical of the forest-steppe area.

As regards the ixodid fauna, there are definite differences between these landscape zones (Table 3).

Transitional subzones and sectors of northern forest-steppe merging into it are characterized by pure or almost pure population of Dermacentor pictus Herm. (96.8% of the entire ixodid fauna), while in the northern forest-steppe the ecologically close species Dermacentor marginatus Sulz. (23.3%) appears, and in the southern forest-steppe, particularly in the steppe this species completely predominates (83.8%-97.6%). Southward, the population of Dermacentor pictus becomes more sparse and only in some confined sectors of the forest-steppe does the density of this species increase within the composition of ixodid fauna, but it never reaches corresponding indices for the species that dominates, Dermacentor marginatus Sulz. (V. I. Alifanov, and G. I. Netsky).

In recent years, infection with hemorrhagic fever was recorded in the zone where these two tick species occur together as well as in the zone of absolute predominance of Dermacentor marginatus Sulz.

Thus, in South Siberia, the southern boundary of distribution of natural foci of hemorrhagic fever proceeds along the southern boundary of distribution of Dermacentor pictus Herm., where the density of this species is greatly reduced, while in the south it is entirely replaced by Dermacentor marginatus Sulz. This is all the more probable, because during recent years among the collections of ticks from the steppe zone, virus-carriage was established in Dermacentor marginatus Sulz., and in collections of ticks from the southern forest-steppe - among them Dermacentor marginatus Sulz., and as well as Dermacentor pictus Herm. Therefore, Dermacentor marginatus Sulz. may also be considered as the vector of Omsk hemorrhagic fever.

Exposure of Omsk hemorrhagic fever foci chiefly in the territory of absolute predominance of Dermacentor pictus Herm. cannot be associated only to the presence of this species.

The northern boundary of distribution of natural foci of this disease is also obscure. In the transitional subzone appear Ixodes persulcatus P. Sch. (2.9%) and sporadically Ixodes apronophorus P. Sch. (1.3%), and in several localities, particularly in the northern belt of transitional subzone, biocenotic relationships of these species link with those of the dominant Dermacentor pictus Herm.

The latter species in turn penetrates into river floodplains, the zone of absolute predominance of Ixodes persulcatus P. Sch.

Recently infection with steppe hemorrhagic fever was also recorded northward of "endemic" localities, in the territory of transitional zone of marshy birch-aspen forests. The clinical picture of these infections undoubtedly is that of Omsk hemorrhagic fever (Yu. V. Veselov). The serum of patients neutralized the virus in sufficiently high titres.

Thus, the northern boundary of natural foci of hemorrhagic fever is located in the territory of existence of two tick species - Dermacentor pictus Herm and Ixodes persulcatus P. Sch.

#### CONCLUSIONS :

1). Ixodid ticks maintain the virus of this disease for a long time, and are essential members of biocenosis of a natural focus of hemorrhagic fever; the existence of a natural focus of hemorrhagic fever is apparently associated with the presence of at least two ixodid tick species (Dermacentor pictus Herm. and Dermacentor marginatus Sulz.) encountered in the western Siberian lowlands.

2). Direct contact with ixodid ticks appeared to be a determining, but possibly not the only factor in occurrence of this disease among humans.

3). The existence of natural foci of hemorrhagic fever is probable within the distribution range of two ixodid tick species throughout the entire extent of the western Siberian lowlands, in any case within the boundary of southern subzone of the taiga and steppe zone of Omsk Oblast.

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Table 1.

Isolation of virus of Omsk hemorrhagic fever from ticks  
Dermacentor pictus

Epidemiological characteristics of focus	Number of ticks in experiment	Place of collection	In which passage strain was isolated	
			Primary infection	Subsequent passages
Annual infection ("K")	111	grass	+	
"Extinguished" focus ("I-S") .....	230	grass	+	
Potential focus ("URS")	128	grass and farm animals		+

Table 2.

Serological test for identification of tick strain (serum of convalescent patients ill with Omsk hemorrhagic fever).

Name of strain	In test	In control	Neutralization index
"I-S"	4.74	8.0	1820
"K"	3.0	5.0	100.0
"URS"	5.0	7.0	100.0

Table 3.

Zonal distribution of ixodid ticks (in %) in the territory of Omsk Oblast  
(Data of mass collections between 1948 and 1952 examined by V. I. Alifanov  
and G. I. Netsky).

Landscape zones and subzones	<u>Ixodes</u> <u>persulcatus</u>	<u>Ixodes</u> <u>apronophorus</u>	<u>Dermacentor</u> <u>pictus</u>	<u>Dermacentor</u> <u>marginatus</u>
Uman-marshy subzone of taiga .....	98.3	-	1.7	-
Transitional subzone	2.9	1.3	95.8	-
Northern forest-steppe	0.02	-	76.7	23.3
Southern forest-steppe	-	-	16.2	83.8
Steppe .....	-	-	2.4	97.6